

# **Biosolids Odorant Emissions as a Cause of Somatic Disease: What Ought to be Our Profession's Response?**

Presentation to 2007 North East Biosolids & Residuals Conference & Exhibit

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December 4, 2007

## **Introduction**

The human species is wired to respond to stimuli of fear. Those stimuli are not the same from individual to individual. One thing for sure, some small proportion of the population, when exposed to odorants emitted from biosolids, will be seriously upset, not merely by the nuisance, but from fear, and they may become physically ill. Biosolids odors communicate a message of fear to some people, and unless biosolids managers are prepared to respond with an effective set of communications, managers become the cause of community upset and consequent rise of committed opposition. The biosolids profession is not alone in causing the kind of upset that biosolids odors can create, nor is it alone in seeking workable responses. Biosolids managers can draw upon the experience of other professions on how to manage their "communications."

## **Humans: The Emotional Animal**

The concerns of humans can be very surprising. A common malady of human communities is a tendency to occasionally "go off the deep end" when it comes to reacting en masse to stories of bad things happening close to home (Bartholomew and Wessely 2002). Scientific literature is abundant with examples of case studies.

- "[A] psychogenic epidemic at a workplace [electronics plant in Sweden] progresses from sudden onset, often with dramatic symptoms, to a rapidly attained peak that draws much publicity and is followed by quick disappearance of the symptoms. Over 90% of the affected persons are women and the symptoms range from dizziness, vomiting, nausea, and fainting to epileptic-type seizures, hyperventilation, and skin disorders" (Olkinuora 1984).
- "A government report concluded that the cause of the recent cluster of illness affecting 57 people at Melbourne Airport was a "mystery". On reviewing the evidence, I noted the appearance of a constellation of distinct psychogenic features (in the absence of an identifiable pathogenic agent or source), and non-specific symptoms not correlated with any particular illness, strongly suggesting a diagnosis of mass psychogenic illness" (Bartholomew 2005).
- "The initial trigger was probably the odour of H<sub>2</sub>S escaping from a faulty latrine in the schoolyard of the first affected school [in Jordan West Bank]. Subsequent spread of the disease was due to psychological and extra-medical factors, including publicity by the mass media. Spread was stopped immediately after closure of schools" (Modan, Swartz et al. 1983).
- "A total of 65 students and one female teacher were afflicted with an unusual illness following alleged inhalation of a 'gas' in the school. The main symptoms were dizziness, chills, nausea, headache, difficulty in breathing and faintness. Initial investigations revealed elevated carboxyhaemoglobin levels (greater than 5%) of 16 hospitalized students" (Goh 1987; Bartholomew 2005).
- "...at a high school in Tennessee. In November 1998, a teacher noticed a 'gasoline-like' smell in her classroom, and soon thereafter she had a headache, nausea, shortness of breath, and dizziness. The school was evacuated, and 80 students and 19 staff members went to the emergency room at the local hospital; 38 persons were hospitalized overnight.... The illness attributed to toxic exposure had features of mass psychogenic illness ..." (Jones, Craig et al. 2000).

Emotional reactions, expressed with feelings of illness, do not occur uniformly among different groups within a community. But, emotionally-triggered symptoms do cross cultures, sexes, socio-economic status and education levels. Such symptoms tend to arise in women more than men, and, in the United States, among Whites more than people of color, and among young people more so than the old. People of all education levels are affected. The appearance of physical symptoms as a response to stress, fear and environmental triggers is a phenomenon that is inevitably present in your community (Boss 1997; Bartholomew and Wessely 2002). In fall 2007, the stress of academia manifested itself as tremors in a teacher and nine high school students (Harrison 2007). (As an aside, biosolids workers may fall at the other end of the spectrum, in that they may be “self-selected” by being inordinately blasé and insensitive to things, like odors, that cause others to be squeamish.)

The kinds of concerns that are stressors and triggers for the reactions illustrated above vary over time and space. The concerns of humans reflect the cultures in which they live. Unidentified malodors are frequently identified as the trigger. Today, bioterrorism is a lively issue, and the heightened awareness of concern for poisonous gases, for instance, may lead to hysteria, worsened by media coverage (Hefez 1985).

### **Hystory: The History of Hysteria**

Elaine Showalter, in her book Hystory: Hysterical Epidemics and Modern Media, linked some of today’s modern health concerns to historical health issues (Showalter 1997). War neurosis is the syndrome of World War I that may be expressing itself today as Gulf war syndrome. Female hysteria of the Nineteenth Century is transmogrified in the Twentieth Century to Multiple Personality Syndrome. Neurasthenia, an archaic term arising in the 1920s for the cluster of symptoms including fatigue and listlessness, is described in the 1990s as Chronic Fatigue Syndrome (CFS). CFS had been regarded as a peculiarly American expression of “neurasthenia” until an American therapist specializing in CFS moved to Denmark, and then CFS began to appear in the European community.

The common link is that human beings may reflect the stresses and fears in their lives through physical symptoms. The fear can arise from many sources – violence, natural catastrophes, loss and isolation -- and it can come from within the family, community or in the larger environment. Fear creates stress that individuals express through physical symptoms. One major psychological paper explains that fear does not arise only with direct experience:

Fear typically peaks just before a threat is experienced and is highly dependent on mental imagery (and thus subject to vividness effects). Fear responses also seem to be conditioned, in part, by our evolutionary makeup; we may be prepared to learn very rapidly about some types of risk but much more slowly about others. Fear responses are evoked, often by crude or subliminal cues. Fear conditioning may be permanent, or at least far longer lasting than other kinds of learning (Loewenstein, Weber et al. 2001).

The medical community has a certain way of describing and treating patients who present with symptoms derived from stress and environmental triggers. Symptoms for which no toxic exposure or pathogen can be discerned suggest self-induced “somatic disease,” also called “functional somatic syndrome” (Barsky and Borus 1999). Medical doctors are trained to measure “signs” of illness, objective evidence of disease causing substances or organisms. Somatic disease arises from causes not traceable to disease organisms or toxic compounds.

The term “hysteria” was coined in the Nineteenth Century to describe symptoms that arise from non-pathogenic, non-toxicant causes. Today, instead of the term “hysteria,” the form of somatic disease triggered by fears and environmental agents is given term “psychogenic illness” or “sociogenic illness.” The term “mass hysteria,” when applied to a group expression of somatic symptoms, is replaced with its modern equivalents “mass psychogenic illness” and “mass sociogenic illness.”

The list of symptoms that appear in our culture from stressors and triggers as somatic disease is long: dizziness, hyperventilation, chills, nausea, headache, difficulty in breathing and light-headedness (faintness), abdominal pain, and chest pain (Colligan, Urtes et al. 1979; Olkinuora 1984; Goh 1987; Struewing JP 1990; Pastel 2001).

Interestingly, other cultures may express a variety of other somatic symptoms, such as convulsions, pseudoseizures, laughing and hysterical dancing (Boss 1997).

Many “popular” illnesses today may have somatic roots. Showalter’s book investigates alien abduction, chronic fatigue syndrome, satanic ritual abuse, recovered memory, Gulf War syndrome and multiple personalities disorder. Barsky and Borus go further than Showalter in their list of “syndromes” that, in their opinion, arise from non-pathogenic, non-toxic causes (Barsky and Borus 1999). Their list of diseases include, as “functional somatic syndrome,” sick building syndrome, silicone breast implant syndrome, irritable bowel syndrome, and fibromyalgia. Barsky and Borus argue that these illnesses share these features: sensationalized media coverage, a suspicion of physicians, self-interested parties championing the illness, and over-reliance on biomedical solutions over psychosocial factors.

### **The Professionalization of Problems**

The enormous breadth of professional specialization in today’s culture has ensured that those syndromes which, to a cultural anthropologist, at least, look clearly similar will take on distinctly special qualities in the hands of championing specialists. The list of professionals who engage symptomatic clients includes family doctors, public health professionals, epidemiologists, occupational medicine physicians, toxicologists, social psychologists, and emergency responders, and then, too, a host of “allied” health professionals, such as masseuses, nutritionists, therapists, and counselors. Each profession has its own vantage point and pattern of response, and few therapists and health professionals step back to see the big picture.

The medical science community’s “dismissal” of somatic illnesses itself is a cultural bias. In the US culture, somatic diseases are given short shrift, and sufferers seem to feel disrespected and ignored. Getting a referral to a psychiatrist instead of to a medical specialist for such symptoms as short-breath and palpitations is commonly resented by the patient.

The cultural bias in the US medical community to down-play the importance of somatic diseases is the fertile ground that cultivates the popularity of “syndromes.” Showalter documents a process whereby a new syndrome develops (Showalter 1997). She demonstrates across many syndromes the way in which culture gives identity to clusters of symptoms of stress and fear in individuals prone to developing somatic disease. Because medicine is the medical profession’s tool to fix disease, when a doctor provides no medicine, patients go elsewhere, seeking sympathetic therapists. Persons sharing common stressors may gravitate to a “specialist.” This therapist has gathered together clients of similar symptoms, formed them into a clique, and publicized the “new disease.” Sufferers feel justified when they have a therapist that can put a name to their symptoms; they feel consoled. Symptoms that are otherwise broadly similar across time and space are given different names by different therapists, and those newly-named symptom-clusters each becomes its own “syndrome,” attracting its own set of adherents and believers. History of hysteria has generally shown that, eventually, somatic-based syndromes slowly fade from the scene as the prevailing cultural evolves, only to be replaced by newer ones.

### **Environmental Triggers for Somatic “Dis-ease”**

Fear of environmental pollutants is one source of stressors to which individuals may react with physical symptoms. Reaction to environmental stressors has been called Multiple Chemical Sensitivity, but the term has been recently replaced with Idiopathic Environmental Intolerance, or IEI.

Human psychological processes connect environmental triggers to symptoms of disease. Some scientists work in the area of discerning human response to toxic concentrations of air pollutants from non-toxic concentrations and the IEI they invoke. The objective of their research is to develop ways to tell IEI from true signs of toxic exposure (Shusterman 2001).

Principal researchers in IEI are clear that IEI does not arise from exposures to toxic compounds (Staudenmayer 2000). Instead, IEI is a somatic disease: “We conclude that IEI is a belief characterised by an overvalued idea of

toxic attribution of symptoms and disability, fulfilling criteria for a somatoform disorder and a functional somatic syndrome” (Staudenmayer, Binkley et al. 2003). Poonai draws a connection between IEI and underlying psychiatric illness (Poonai, Antony et al. 2001), and this conclusion is supported by others (Black 2000), even in those cases when central nervous system involvement is not fully ruled out (Bolla 2000). According to Binkley, King et al: “Panic in response to an environmental trigger, such as a foul odor, is the likely cause: panic disorder may account for much of the symptomatology in at least some cases of IEI and provide a basis for rational treatment strategies” (Binkley, King et al. 2001; Tarlo SM 2002). When a variety of reports of MCS/IEI were reviewed, other medical researchers concluded: “This investigation confirms previous findings that psychiatric morbidity is high in patients presenting to specialized centres for environmental medicine. Somatoform disorders are the leading diagnostic category, and there is reason to believe that certain 'environmental' or MCS patients form a special subgroup of somatoform disorders. In most cases, symptoms can be explained by well-defined psychiatric and medical conditions other than MCS” (Bornschein, Hausteiner et al. 2002). In Sweden, researchers, calling IEI by the name Environmental Somatization Syndrome (ESS), arrived at the same conclusion, and made the delicate point: “The patients usually refuse alternative explanations of their symptoms and discredit and reject any suggestion of a psychogenic etiology” (Göthe, Molin et al. 1995).

IEI incidences display differences among population groups. Researchers have also observed that females are more likely than males to express symptoms of IEI and to have malodors trigger IEI (Diamond, Dalton et al. 2005). Yet there are some examples of largely male dominated disorders, one being with a group of military recruits who were triggered by malodors (Struewing JP 1990).

Scientists working at the scale of large groups experiencing illness, as in mass hysteria, have also identified odorants as a major factor. Robert Bartholomew and Simon Wessely, in the British Journal of Psychiatry, provided a comprehensive overview of this phenomenon and claimed: “During the 20th century, epidemic hysteria episodes were dominated by environmental concerns over food, air and water quality, especially exaggerated or imaginary fears involving mysterious odors. Outbreaks had a rapid onset and recovery and involved anxiety hysteria. Unsubstantiated claims of strange odours and gassings were a common contemporary trigger of MSI outbreaks in schools” (Bartholomew and Wessely 2002). The military recruits mentioned above were triggered by a “suspected toxic gaseous exposure” (Struewing JP 1990).

### **Pathways of Biosolids “Dis-ease”**

The biosolids-aligned experts and their messages on behalf of the wastewater profession have been consistent and clear -- biosolids does not spread disease-causing organisms and its vaporous emission are not toxic chemicals (Chrostowski and O'Dette 2002; Blaser 2003; O'Dette 2004). Stories perpetuated on the Internet about young men dying in Pennsylvania and New Hampshire and about cows dying in Georgia have been thoroughly addressed by the EPA in its response to the Centers for Food Safety petition as entirely without foundation (Mehan 2003).

Such reassurance by wastewater experts has not carried the day, and public credence given to governmental reassurances is less than the wastewater profession would like to believe. People who seek out information about biosolids from the Internet can uncover apparently credible scientific debate over the biosolids-health connection. A few scientists hold out the theory that biosolids odorants, even if not directly toxic, can directly cause disease. Notable in this group is David Lewis, a former EPA scientist (Lewis, Shepherd et al. 2001; Lewis, Gattie et al. 2002). The National Academy of Sciences was called upon by EPA and Congress to weigh in on issues of public health effects of biosolids. While the wastewater industry points to the report of the NAS to demonstrate the adequacy of current processes and regulations, a sufficient number of gaps in scientific evidence in certain areas were identified to open a wide berth for festering public concerns:

The committee concludes that because of the lack of epidemiological study and the need to address the public's concerns about potential adverse health effects, EPA should conduct studies that examine exposure and potential health risks to worker and community populations (Anonymous 2002).

Not every epidemiologist and health researcher has felt comfortable with complete reliance on psychosocial factors as the explanation for symptoms of illness induced by exposure to biosolids. Experts in related areas are working to decipher the potential for a connection between odors and health. Researchers have examined the process by which odors can induce health effects. One researcher has shown that odors can cause hyperventilation, leading to light-headedness (Van Diest, De Peuter et al. 2006). These researchers have also shown that odors can induce asthma symptoms (De Peuter, Van Diest et al. 2005). The Journal of Agromedicine published a major review of the potential health effects of odors from swine and wastewater operations (Schiffman, Walker et al. 2000). Three hypotheses were explored: 1) could odorants also be irritants and toxicants, directly resulting in ill-health; 2) could odorants be associated with other non-odorous compounds that are producing toxicity; 3) could odorants trigger somatic symptoms that are experienced as ill-health by sensitive individuals.

The first hypothesis, a direct linkage between community health and malodors, is very difficult to completely dismiss. When Dr. Lewis had an opportunity to make a “best case” for a linkage between biosolids odor and health in court, his arguments were not compelling to the court. One major study of health effects of malodors from hog operations (odors that can bear resemblance to municipal wastewater operations) has provided no conclusive scientific results that a linkage exists (Cole, Todd et al. 2000). But “proving a negative,” in this case proving odors do not cause illness, is in itself a tough scientific enterprise.

The second hypothesis is that some non-odorous agent emanating from biosolids along with odorants is toxic or disease-causing. Researchers working on “sick building syndrome” seem to be connecting chemical releases from mold to human allergic reaction (Karunasena 2006). Other researchers are working on a hypothesis that very low concentrations of odorous or non-odorous airborne chemicals may affect inflamed receptor cells in the sinuses or lungs of already ill patients (Cain 2007). Asthma is an example of a disease that might be worsened by such airborne exposures.

While in highly sensitive individuals, non toxic chemicals may trigger asthma or other diseases, for most part biosolids odors have not been shown to trigger health impacts, as speculated in the Journal of Agromedicine. The wastewater industry has made progress since the NAS report in answering this hypothesis scientifically. Papers have been presented at biosolids specialty conferences dealing with biosolids odors and health (Epstein 2003; Liver, Apedaile et al. 2003). WERF has sponsored research identifying the organic chemicals responsible for biosolids odors, and the concentrations the researchers have measured can be shown to be non-toxic levels (Forbes, Adams et al. 2003; Forbes, Witherspoon et al. 2006). WERF published a report by William S. Cain and J. Enrique Cometto-Munoz of the Medical School of the University of California, San Diego, “Health Effects of Biosolids Odors: A Literature Review and Analysis” (Cain and Cometto-Munoz 2004), which concluded odorants are not toxic. Regulatory agencies responsible for issuance of permits for biosolids, notably the state of California and the province of Ontario, have issued comprehensive reviews of the evidence of health effects of biosolids (Liver, Apedaile et al. 2003; Anonymous 2004). These reports have made the case that chemicals and biological agents are not emitted from biosolids at concentrations that directly cause toxicity or disease.

The Water Quality Centre at the University of Arizona has championed field studies of bioaerosols and other pathways of human exposure to biological agents. Evidence to date is that concentrations of microorganisms and microbial agents are too low in the community downwind of land application sites to be infective, although significant concentrations may be released in the vicinity of operations, particularly in field conditions of high winds and dry weather (Brooks, Maxwell et al. 2005; Brooks, Tanner et al. 2005; Brooks, Tanner et al. 2005; Paez-Rubio, Huab et al. 2006; Paez-Rubio, Ramarui et al. 2007).

What is left is the third hypothesis. Experts to the wastewater profession have not been able to dismiss the role of biosolids in triggering IEI and psychogenic illnesses. Evidence supports the third hypothesis, which is biosolids odors trigger somatic disease. Fear and panic are at play, not biosolids directly.

Not every scientist is comfortable accepting the argument that biosolids odors are not rightfully classified as disease-causing in their own right. They ask: Is not a somatic reaction to a malodor a health impact? The World

Health Organization says that health is adversely affected if quality of life is harmed; specifically “health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (Anonymous 2007). Believing, too, in the fallibility of current scientific tools, they also argued in favor of a “precautionary” approach to “eco-toxics,” suggesting prudence in spreading of biosolids in the environment in advance of proof they do, or do not do, harm (Cairns 2003). Medical epidemiology declares that disease must arise from a pathway involving disease organisms or toxicants. But social and cultural epidemiologists approach disease with a concern for patterns of distress and help-seeking (Masse 2006; Waldram 2006). Human experience of disease is sufficient to establish a negative health impact from an exposure, even when stress is the cause, when viewed from this vantage point.

If a somatic reaction to a malodor from biosolids can be legitimately equated with a negative health effect, then the wastewater profession’s focus on pathogens and irritant emissions may be unreasonably narrow.

Human reaction to odors is not just a matter for a subjective inquiry; it is the matter of scientific inquiry. Research into human response to odors is a billion dollar inquiry when it comes to food and flavorings, but bad odors are different story, though thankfully several prominent scientists have taken this on. One such scientist is Pamela Dalton at the Monell Chemical Senses Center in Philadelphia. Dalton is social psychologists whose career has been spent measuring human beings’ responses to foul odors. She and other researchers at Monell have worked with hog manure odors, and Dalton is working with the US Department of Defense on a non-toxic crowd control chemical based on “Who-me?” and the ASTM Bathroom Malodor (Dalton 2007).

Dalton has shown that malodors trigger somatic illnesses and, specifically, that biosolids odorants can trigger Idiopathic Environmental Illness, a form of psychosomatic “dis-ease” (Dalton and Hummel 2000). Dalton has demonstrated aversion to “bathroom malodors” across all cultures and classes. She has shown, too, that women of child bearing age can increase their sensitivity to these same kind of odors, compared to other age and gender classes, when exposed to “puffs” of bad odors. Ironically for the wastewater industry, workers exposed continually to these same odors become less sensitive, setting up a classic case of mis-communication between a plant manager and a distraught neighboring mother.

Knowledge of odors affects human response. Dalton has shown that foreknowledge is critical for an individual to ascribe “meaning” to an odorant. The same odorant chemical that is offensive when said to be associated with a homeless person may be judged okay when ascribed to an athlete. This observation helps explain how the media influences public reaction to biosolids and biosolids odors (Diamond, Dalton et al. 2005). Media stories focusing on fear and anger foster negative perceptions of odors. Dalton has participated with the wastewater industry in helping to identify scientific questions it needs to address in order to demonstrate the link between odors and human response. Dalton has recommended, for instance, community monitoring of odorants and other possible emissions (Dalton 2006).

### **Sludge Syndrome**

While the biosolids advocate may choose to emphasize evidence of no pathogens and no toxic emissions, the biosolids critic responds with the observation: If biosolids is so safe, then why do reports persist of community health impacts? The biosolids professional can no longer avoid confronting persistent reports that neighbors report exposure to biosolids as a cause of bad health for them.

The Cornell Waste Management Institute has championed the collation of stories of bad health experienced by neighbors to application sites. The CWMI hosts a web site that gives definition to symptoms in individuals exposed to offensive biosolids nuisances and gives it the name “Sludge Syndrome.” That there is such a syndrome should come as no surprise, as Sludge Syndrome follows the model described by Showalter in Hystories.

The Cornell Waste Management Institute (CWMI) makes its “reported health effects” into a Cornell-based website, largely drawing on information compiled by Helene Shields at her [www.sludgevictims.net](http://www.sludgevictims.net) website (Harrison 2007; Shields 2007). In 1999, the term sludge syndrome came into use by persons opposing biosolids

application, and the term came to refer to the symptoms listed in the CWMI website. Sludge syndrome is a collection of self-reported symptoms that look very much like other panic-like, IEI-related syndromes. The symptoms are a diverse assortment with no clear link through objective pathways to causative agents, but nonetheless impacting on quality-of-life (Harrison and Oakes 2002). It is from within the community of sufferers identified by the CWMI website that common, concerted efforts have been initiated to call public attention to the presumed causes of the syndrome (Shields 2007). Some of the self-reported health conditions find their way into the media, even the national media (Fackelmann 2002; Staff 2004).

The CWMI website (accessed 8/27/2007 from <http://cwmi/css.cornell.edu/sludge/INCIDENTS.htm>) charts out the situations that gave rise to “more than 328” people who expressed a certain category of symptoms (Harrison and Oakes 2002). The list of symptoms is long: asthma, allergies, birth complications (i.e. premature births, congenital defects), cysts, abscesses, dry heaves, cough, eye problems (i.e. burning eyes, watery eyes), flu-like symptoms, gastrointestinal complications, stomach cramping, headaches, immunodeficiency problems, lesions, mucous, nausea, nosebleeds, respiratory complications (shortness of breath), skin rashes, tumors, vomiting, weight loss, burning throat, burning nose, and fatigue.

From this large list, several reported symptoms of sludge syndrome dominate the reports. Of the 65 case studies reviewed, 42 reported stomach problems (nausea, gastro-intestinal/stomach cramping, or dry heaves/cough), 40 reported respiratory complications, 34 reported headaches, and 20 reported eye problems. These symptoms closely align with the list of symptoms known to be somatic disease responses identified as IEI in response to odor triggers.

### **The Role of the Media in Somatic Illnesses**

Human response to environmental triggers is, as Dalton shows, influenced by information retrieved from the community, and from newspapers, radio, TV and Internet. Neighbors reporting symptoms of sludge syndrome present a story compelling for news reporters. Media can quickly and graphically report stories of situations involving sludge syndrome initiated by foul odors and can support evolution in a community of mass hysteria. Researchers have shown that the media can accelerate the development of symptoms in response to environmental exposures to chemical odorants (Winters, Devriese et al. 2003).

Two sides of a coin are presented by the media in responses to environmental triggers of somatic disease. While the first side of the coin increases public concern, the other side of the coin is the opportunity for wastewater experts to communicate messages of reassurance. Research on the role of media in response to releases of environmental toxins and hazards – before, during or after release events – has shown that the media can serve to defuse hysteria. The key is in effective, well-constructed messages. Successful examples include public health officials working with food poisoning and emergency responders working with terrorism incidents (Small and Borus 1987; Winters, Devriese et al. 2003; Vasterman, Yzermans et al. 2005). The challenge for biosolids is that the first side of the coin usually is manifest.

The media is not the first place for a biosolids manager to start if his goal is to communicate reassurance. Research into cases of media coverage of toxic releases has shown that the media is not effective at presenting information that allows citizens to evaluate true risks of a toxic release or disease organism and that allows citizens to take appropriate actions (Dudo and Dahlstrom 2007). Public meetings on issues of controversy involving environmental risks often result in coverage that emphasizes conflict between opinions, and points of view of experts may not be accorded any more authority than those of upset citizens.

Media are drawn to stories of governmental malfeasance. Biosolids managers seeking to put out positive messages confront a public taught to be skeptical of government intentions. No stories persist in the media with greater popularity than that of government conspiracies, and the story line is as old as history itself. A recent radio story on NPR told of a survivor of the London subway bombing who elected to confront a former British official who championed a weird notion that the British spy service had faked the bombing to create support for its anti-Muslim conspiracy. The story of British government conspiracy continues to persist even in the face of

incontrovertible evidence to the contrary (Glass 2007). Elaine Showalter in *Hystories* drew a connection between somatic diseases and reports of alien abduction, a phenomenon which is made plausible only by a concomitant belief in a government cover-up of alien sightings. In fact, some of the “chroniclers” of alien abduction are based in university settings, enhancing the credibility of the claims (Jacobs 2007).

Alleged government cover-up of the true “toxic” nature of biosolids is central to local opposition to biosolids recycling. For this to be true, a vast conspiracy must seem plausible among ten thousands of biosolids professionals in utilities, government, university, and industry. A positive influence by the media on public understanding of environmental risks requires that the media confer on its experts a high degree of credibility. But when the media uses “governmental spokesmen,” the distinction between credible and not credible may not be clear. Virtually no one associated with the operation of a biosolids recycling operation, even if employed by government, will be viewed by the public as neutral, having no “stake in the game.” Furthermore, the extent to which public agencies contract out land application services to service companies will be the extent to which profits are suspected as the motive behind which is hidden the true risks of biosolids recycling.

### **How Other Professions Respond to Crisis**

The wastewater profession is not alone in needing to learn how to respond to environmental fears. Emergency responders preparing for terrorist acts, public health officials responding to upset at “cancer clusters,” and public officials seeking places to dispose of nuclear waste – each of these professions are concerned with how to bring sound scientific information to people in a way that instills confidence, not fear.

Emergency responders, planning for the risk of bioterrorism, need to be able to discern those people responding in fear from those responding to a toxic agent itself (Engel, Locke et al. 2007). Experts in bioterrorism preparedness regard as a serious issue the possibility during a bioterrorism incident that emergency responders may confront “me-too-ers” who present somatic symptoms in response to threats (Jones, Craig et al. 2000). The medical community is concerned that its primary care physicians and other “early responders” be able to discern cases of mass sociogenic illness and IEI from cases of individuals genuinely exposed to toxicants (Talbot 2002; Weir 2005).

The general public, the media, and many government officials believe that use of weapons of mass destruction (WMD) will inevitably lead to mass panic and/or mass hysteria. Studies of disasters and wars show that disorganized flight (i.e., mass panic) is rare in the event of a specific danger (Small and Borus 1987). On the other hand, in a real or perceived WMD scenario, outbreaks may be prevalent of multiple unexplained symptoms as evidence of somatic illness (i.e., mass psychogenic illness, mass sociogenic illness, mass hysteria, or epidemic hysteria). That is because many of the symptoms of toxic chemical exposure and acute radiation sickness are also symptoms of somatic illness (fatigue, nausea, vomiting, headache, dizziness/lightheadedness, and anorexia) (Pastel 2001).

State public health agencies are occasionally called upon to respond to a cancer cluster scare. A report in the community that some invisible agent is causing an unusual clustering of cancer cases can spiral into a widespread scare. But, a variety of tested approaches have been developed by public health experts to defuse these concerns. The key is credible experts issuing clear, technically sound explanations (Thun and Sinks 2004).

Environmental official trying to site any number of locally undesirable land uses, or LULUs, will trip upon scares in the community – such as concern for groundwater contamination and methane emissions from municipal solid waste landfills. In many LULU projects, public information meetings set up by industry expert to convince neighbors that safe conditions will be maintained fail in their mission, in part because the “expert” is unable to establish credibility responses to the fears (Flynn, Slovic et al. 1994).

Lessons drawn from other professions dealing with events evoking somatic illness are that the medical community cannot on its own reliably distinguish toxic/pathogenic illness from somatic illness, and local government/utility spokespersons and their experts also carry little authority in quelling public concern. A higher level of neutral authority, grounded in scientific evidence of exposures and risk, is warranted.



## **New Approaches Needed to Link Biosolids and Health**

Biosolids managers are faced with this situation: biosolids can cause “dis-ease” through the fear inspired by noxious odors and consequent panic in sensitive individuals, even though odors are neither toxic nor pathogenic, but without further research, the toxicity and pathogenicity of biosolids will remain suspect. Further research into biosolids-borne pathogens and odor-causing constituents in biosolids will have limited value unless they are tied to specific work on pathways of exposure, measures of air-borne constituents, and objective signs of health.

From this vantage, in which pathogens need not be present to cause somatic illness, Class A versus Class B biosolids may prove to not be a meaningful distinction for a biosolids’ potential for causing “dis-ease.” The Class A versus B distinction deals with the presence or absence of pathogens, but odorants are the triggers for somatic disease, not microorganisms. What is more, recent research findings into the changing population densities of pathogens and indicator organisms post-dewatering suggest that current regulatory approaches may likely evolve in the future. The wastewater profession may be well-advised to move beyond full reliance on Class A versus Class B compliance as a measure of performance.

No regulatory standard have yet been established that enables the wastewater industry to define biosolids products that are noxiously odorous, and apt to trigger somatic disease, from those that are not. On the face of it, the Vector Attraction Reduction portion of the federal regulations is thought to set that standard. The wastewater profession cannot deny, though, that cases of Class A products meeting the VAR standard, yet emitting noxious odors, have occurred, even with some regularity. Examples of such cases are putrid biosolids compost along highways, noxious advanced-alkaline stabilized biosolids near elementary schools, and stinky piles of biosolids pellets in a farmer’s field. Each has created community upset and reports of ill-health, yet each was purportedly a Class A/VAR-compliant product.

Does the biosolids profession need to respond to unregulated characteristics of biosolids that evoke somatic disease? This is a question of ethical principles. Most individuals within the biosolids profession would proudly wear the label “environmentalist,” as they are persuaded by their own commitment to clean water and recycling. But, a community offended by an odorous biosolids operation will find that label not credible, at best, and, yet worse, hypocritical. The biosolids profession would be better off if it were to respond actively to reports of ill-health of neighbors, even though it may be firmly convinced of the environmental and public safety of its practices. The biosolids profession might hold a higher ethical ground if it would demonstrate that it understands that biosolids odors may not only create temporary nuisances but evoke somatic disease in sensitive people.

To make a start in responding to its incomplete understanding of the role of biosolids in causing somatic disease, the biosolids profession is taking the lead from a stakeholder workshop on biosolids research priorities. WERF has a project for “Protocols for the Timely Investigation of Potential Health Incidents Associated with Biosolids Land Application” (Wing 2007). This work has not yet been released; its focus will be on a modality for collecting health reports and evaluating them for follow-up by health and environmental officials. No judgment on previous reports of ill-health from community exposure to odors will be assessed.

## **Wastewater Manager’s Role in Controlling Biosolids “Dis-ease”**

The CWMI, and its network of contributors in Massachusetts, New Hampshire, Pennsylvania, Ontario and California, may be cataloging and championing the sludge syndrome, but the wastewater profession created this syndrome. This profession comprises the experts in wastewater, responsible for the environmental releases of compounds that are triggers for the syndrome. This profession comprises the experts who have management responsibility for actions that mitigate nuisances, such as odors, truck traffic, unsightly piles and dirty equipments. The profession is constituted with individuals who do, or do not, put out information to the public before, during and after biosolids spreading activities. The profession is constituted with the experts who either do, or do not, accept responsibility for the perceived harm to the community and who do, or do not, establish a reputation for credibility on which the believability of our information is judged. In truth, the buck stops with the biosolids profession for

incidence of sludge syndrome in their communities, and, hence, the “dis-ease” caused by biosolids recycling activities.

Here are steps that the wastewater profession can take to control “Biosolids Dis-ease:”

### **1. Take on a public presence to build credibility and reputation.**

The public credibility of the wastewater and biosolids profession is undermined by practices that suggest it does not really care about its impacts on the community. The profession’s limited ability to utilize processes that deodorize biosolids prior to recycling, its careless spreading of highly odorous biosolids offended the community, its reluctance to meet with the concerned public, and its eagerness to save money through contracted services with low-bid vendors are all factors contributing to circumstances that have resulted in community offenses and fear. Credibility and reputation need to be built from the top of the organization and extend out into the field and with the contractors employed by public agencies.

### **2. Reduce risk of nuisance odors in biosolids product and programs**

Until about 6 years ago, not a single peer-reviewed scientific article had characterized the organic compounds emanating from biosolids products which held the potential for giving offense. Even today, scientists do not know the specific identity of all volatile organic compounds that are emitted from biosolids application sites. The wastewater profession does now know, in contrast to what was known in 2000, that biosolids odors are influenced strongly by dewatering equipment, worsen with age over several day after dewatering, may differ from season to season, and are affected by upstream discharges and plant processes. The profession now knows that Class A versus Class B is not a distinction which ensures nuisance-free biosolids distribution. But even after 6 years of research, the wastewater industry still does not have available an array of technologies from which it can select that are proven to produce sweet-smelling biosolids. Biosolids generators and users need to collaborate on sharing “lessons learned” in reducing nuisance odors.

### **3. Communicate on odorants to public in anticipation of “biosolids dis-ease”.**

The wastewater profession knows that a certain number of individuals within sight of, or within an odor plume reach of, its operations may be subject to Idiopathic Environmental Intolerance. Persons with IEI will be inordinately reactive to bad odors. But unless affected individuals are given access to the biosolids managers, managers will be unable to learn who their sensitive neighbors are, where they are, and what the managers can do to offset impacts from their recycling operations. What is more, the biosolids profession has positive messages about the benefits and safety of biosolids recycling that, through information sharing, may offset the negative messages communicated by the odors and by highly-impacted individuals communicating over the Internet. Biosolids managers need to develop a communications plan that puts out information on its practices and programs in advance of operations that might cause IEI-inspired complaints.

### **4. Respond to concerns timely and face-to-face.**

Timely response and face-to-face communications can be effective in responding to the concerns of persons of IEI sensitivity to biosolids odors or to other concerns. Biosolids managers can give the public the identity of the odorants coming from biosolids, they can anticipate patterns of environmental exposures, and they can find ways to modify operations to reduce potential exposures. Tailoring a communications package to the “average person” is not adequate. One size does not fit all, and one-on-one communication, though time-consuming, is more effective than letters and news articles. The “timely-response” procedures being developed by WERF may one day provide guidance to the biosolids managers on how to carry out a person-by-person approach, particularly with persons exhibiting IEI.

### **5. Support research into worker and public health, basic epidemiology and odor science.**

The wastewater profession dropped the ball on keeping its historical linkage to public health and epidemiology. The profession does not have scientific studies that examine health effects of biosolids on workers and neighbors; it instead points to anecdotal evidence of “no-damage-done.” The profession has not rigorously examined the health of neighbors adjoining biosolids application sites with the new kinds of measurement and analytical tools developed

in recent years. The profession hasn't entirely re-examined the biosolids itself with new tools of analysis, such as polymerase chain reaction (PCR), for the pathogenic organisms known to exist in the wastewater-shed, and so it has not yet re-established the effectiveness of biosolids treatment processes to eliminate pathogens. Unless the wastewater profession joins together in a commitment to this greater investment in research, lip service given to its commitment to public health will appear disingenuous, hurting the profession's credibility.

#### **6. Alter field practices in response to odor complaints.**

Land application of odorous biosolids is risky for the offense it may cause in a community, and likely no single practice will ensure successful odor mitigation. But, regardless, odor complaints from a land application site ought to result in serious steps by an agency or its contractor, and usually several steps, to reduce nuisances. This is not a facetious suggestion, as agencies are often greatly challenged to alter operations in response to unexpected community complaints. Also, agencies contracting with service companies may believe wrongly that its contractual vehicle absolves agency managers from responsibility for community odor impacts from its biosolids.

The responsible biosolids generator will work to eliminate odor nuisances in all of its operations. The first place to look is in the timing and location of biosolids application, to reflect unique conditions of topography, wind direction, sensitive receptors, weather and time of day. For example, Philadelphia doubled the setback zone, had its contractor delay spreading until after 9 AM and plow fields promptly, thereby mitigating odorant exposure to one neighbor with IEI. In another example, Philadelphia had its contractor use a high-carbon coal ash to adsorb odorants from heavy rates of biosolids at a mine reclamation site. When a contractor is delivering to an application site with known sensitive neighbors, Philadelphia loads the truck with the most recently dewatered biosolids, because research has shown a sharp increase in odors occurs after 24 hours. Research has shown, too, that a meaningful reduction in biosolids odors can be accomplished with reducing centrifuge bowl speed without sacrificing cake solids.

#### **The Bottom Line**

Sludge syndrome is a somatic disease triggered by biosolids odors and by fears raised in the community and through the media. The wastewater profession needs to accept that even a large commitment to compiling scientific proof that biosolids are not sources of pathogens or toxicants is of limited persuasiveness with the public. IEI and associated mass sociogenic illness syndromes, the underlying cause of sludge syndrome, may not commonly occur in the population, but the potential is nevertheless significant and meaningful for these syndromes to be manifest in vicinity of any biosolids land application operations. The wastewater profession can prepare itself for this potential, as it has control over virtually all factors that may provoke the sludge syndrome. These factors include the agency's credibility in the community, the quality of agency operations, its responsiveness to odor complaints, and its willingness to adjust operations to reduce odor nuisances affecting sensitive populations. Biosolids managers choose where the piles are placed and choose where and when the biosolids is spread. Biosolids managers choose the kind of information they give to the neighbors and their local officials. Biosolids managers choose whether the response to complainants is quick and effective. In this way, biosolids managers choose whether biosolids odors are communicating to their neighbors that the agency activities are benefiting the environment and whether the agency cares about the neighbors as potentially-affected parties. So, within the influence of the biosolids manager is whether his biosolids communicate with neighbors in a way that builds support for the recycling program.

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